An Abſtract of a Letter of Mr. Anthony Leewenhoek Fellow *of the R.* Society; *concerning the parts of the* Brain *of ſeverall* Animals; *the Chalk* Stones *of the* Gout; the Leproſy; *and the* Scales *of* Eeles.

HAving lately been imployed about the Eyes of Turky Cocks, I proceeded to examine the Brain; and tho' in my Letter of the 14th. of May 1677, I have already treated of that ſubject, I ſhall take no notice thereof, but lay down my Obſervations I hope more diſtinctly and ſubſtantially then before.

I firſt took in hand the *Cortical* parts of the brain of a Turky Cock, theſe parts (a great number of ſmall blood Veſſels and ſmall Globules excepted,) conſiſt of a very clear Cryſtalline Oily matter, which for its tranſparency ought rather to be named *Vitreous* then *Cortical.* When I ſeparated a little of this matter from the reſt, there flowed from the place (tho' it ſpread leſs then $\frac{1}{10}$th of a hair,) a little thin moiſture, containing in it ſome extream ſmall Globules, leſs then $\frac{1}{36}$th part of one of thoſe which make the rednes in the blood. It is to be noted that this fluid matter, was cheifly in the brain of ſuch Turkeys, as had been dead for ſome time. It is alſo not improbable, that a part of this moiſture might flow out of ſome of the ſmall Veſſels, or that ſome of the very minute Veſſells might have been turned into a watery ſubſtance.

Beſides the aboue mentioned ſmall Globules, there were alſo ſome about the bigneſs of $\frac{1}{8}$th of a Globule of our blood. Theſe two ſorts I conceived might have come from ſmall Veſſels which by chance I had broken, being made out of the groſſer parts of the fluid, at the time that the humours grow cold and ſtagnate.

Together with the above mentioned Globules, there

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were ſome tranſparent irregular ones, as big or bigger then a Globule of our blood, which lay among the branches of the blood-Veſſels, in a ſpace no bigger then a courſe ſand. Many of theſe blood Veſſels were ſo ſmall, that if a flat ovall particle of blood (which cauſes the redneſs therein,) being ſuppoſed to be perfectly Globular, were divided into 500 parts, yet could not one of thoſe parts paſs thro their Cavity's, without being more divided and fitted to enter them. For if the wideneſs of the Cavity, be as 1. the Diameter of the Globule is as 8. and conſequently the proportion as. 1. to 512.

Tho' theſe blood Veſſells were ſo ſmall, as is before ſaid, they had notwithſtanding ſuch a degree of colour, that I could diſcern the matter in them, to be that which maketh the blood red. And I was further confirmed in my Judgment, by obſerving that other blood Veſſells, which were ſome what thicker, appeared proportionably higher coloured, and more inclining to red: and that the redneſs appeared more plain, when 3 or 4 Veſſels lay immediately one over the other, without any other matter intervening.

The cauſe of the browniſh colour of the *Cortical* parts, I take to be the great number of Veins and Arteries, which run thro' the tranſparent ſubſtance, whereof theſe parts chiefly conſiſt. To which may be added that there were ſeverall particles mixt about as big as $\frac{1}{6}$ of a blood Globule, which were not tranſparent. We may perceive that the *Cortical* parts in many places enter deep into the *Medullary*, but if we diligently ſearch into them, we ſhall find them as full of blood Veſſells as the outſide.

Beſides the aforementioned very thin blood Veſſells, there are other Veſſells in the brain, ſo thin, that I conceive a round body (as aforeſaid,) altho' divided into above a 1000 parts, could not paſs through them.

Tis to be noted that in theſe Obſervations, are mentioned only ſuch blood Veſſels, which are as thick or thicker then a hair of my head.

But to come to the *Medullary* parts of the brain, there in were contained irregular Globules of different ſizes, ſome of which were of the bigneſs of a Globule of our blood, and ſome larger, ſeeming to conſiſt of a thin tranſparent Oyl-like ſubſtance; theſe are here in ſuch numbers (chiefly where the *Medulla ſpinalis* beginneth,) that they ſeem to compoſe the greateſt part of the brain. This great number of tranſparent Globules, cauſes a white colour (for all tranſparent bodies, which are not ſo united together, that the Ray of light can in a ſtreight line paſs through them, and ſo make them as it were one body, muſt produce to our ſight a white colour, as I have formerly often ſaid,) theſe irregular Globules, were yet ſo faſt joyned the one to the other, that (when I had layd them very thin, or ſingle before me, and endeavoured to ſeparate them,) ſome would be drawn out to twice their naturall length, and then ſeemed to me, as if they were kept together by netlike threds. This made me think, that the ſmalleſt branches of the blood Veſſels might incompaſs theſe Globules, as we find the ſmall Horizontall Veſſells, in ſome kinds of Wood, give way to the great perpendicular Veſſells, and wind half about them. And I was confirmed herein, when I perceived, many of the foreſaid Veſſells, appeared clear in the middle; and browniſh on both ſides; but more brown, when I had torn the Globules aſunder, and lay'd the thin thred-like parts by themſelves.

In fine the *Medullary* parts of the brain, appeared often like a fiſhers net, between each of whoſe Meſhes, was placed a very plyable ball-like ſubſtance; which changed its figure into round or Ovall according as the ſaid Meſhes were ſtretched one way or other. Moreover the ſaid *Medullary* parts conſiſted of a very great multitude of very ſmall Globules, and ſome clear thin matter, which laſt, I alſo Judged, to have flowed out of the Veſſells, that were broken, as alſo, that ſome of the Veſſells, might have been turned into a Watery ſubſtance.

I obſerved alſo the brains of a ſheep, and perceived in the *Cortical* parts, a very great multitude of extream thin blood Veſſells, containing ſome of the ſubſtance, which maketh the redneſs of the blood; whereby the Cortical parts become of a browniſh colour.

While I viewed the incomprehenſible number, of theſe ſmall Veſſells; It was very delightfull to me, to contemplate how every one of them, ſpread it ſelf into ſeverall branches.

There were alſo a great number of Globules not ſo tranſparent as others that were neer them, and that were in ſize as $\frac{1}{6}$ of a Globule, which maketh the redneſs in the blood: theſe I Judged to have been extravaſated, by the tearing of the Veſſels aſunder, and to have been ſix of them compounded together, when the Veſſells were wide enough to carry them; but when the Cavities were ſo ſmall, that they could not paſs thro' them, they then broke into leſſer parts, and loſt their colour.

For the better repreſenting the inconceivable thinneſs of the blood Veſſells, I made the following Calculations. *viz*. 100 red Globules lyeing ſide by ſide, do not equall the Axe of a Sand: let then a Million of them be equall to its ſolid content. There are blood Veſſells in in the brain, which I judge $\frac{1}{64}$ part of a blood Globule would be too big to paſs thro'; ſo that the Diameter of the Veſſell, is to that of the Globule, as 1. to 4, and if a courſe Sand be divided into 64 Millions of parts, 1 of the parts (if it be ſtiff and unplyable,) will not paſs thro' one of the ſmalleſt Veſſells of the brain.

To proceed, the *Cortical* part of the brain, was conſtituted of ſuch a cleer and Glaſs-like ſubſtance, as I have above mentioned; only with this difference, that it had white ſtreaks or lines, thinner then a hair of my head, which to the naked Eye were inviſible. Theſe I judged to be occaſioned, by a more then ordinary number, of very tranſparent great Globules layd together. I have alſo perceived, brown ſtreakes running thro' the *Medullary* part of the brain, which were only cauſed, as I conceive, for that there were but few, or none of thoſe tranſparent Globules, there placed.

I examined ſome of the parts, which lay neer the beginning of the *Medulla Spinalis*; and I ſometimes thought, I had found out a thing that I was doubtfull of, in the brain of a Turkey: *viz*. That the great tranſparent Oyl-like Globules, were, as it were ſurrounded, with an innumerable quantity of extreme thin, and net-like Veſſels or ſtreakes, mixed with ſome thicker Veſſels, which lay in a line, and excelled in tranſparency, cauſing thereby, where they lay in numbers together, the brain to appear very white: theſe were in thickneſs about $\frac{}{25}$th part of a hair or ſomthing leſs. The other ſubſtances were little differing from what I have before mentioned in the brain of a Turkey.

Afterwards, I carefully examined the brain of an Ox, and ſatisfied my ſelf, that the *Vitreous*, and very tranſparent matter, which makes up moſt of the *Cortical* part, conſiſted of nothing but extreme thin ſtreakes or Veſſels, which were neerly joyned together: but at another time, I could not to content, aſſure my ſelf concerning the ſame. As to the remaining ſubſtance of the *Cortical* parts, I could diſcern no difference, from the brain of other Animals; but that there was not ſuch a Quantity of fluid matter, as in Animals which had been longer dead. I found alſo the *Medullary* ſubſtance of the brain, to be ſuch as I have before mentioned in a ſheep: for it had very white ſtreaks, in the parts from whence the *Medulla Spinalis* taketh its riſe: this extream whiteneſs, was from ſeveral very tranſparent Veſſells, which lay next one the other, and ſeemed to me, only made to carry the matter, by which, the *Medulla Spinalis* and Nerves, are partly nouriſhed and maintained. The greateſt of theſe laſt Ducts, (by gueſs,) was about $\frac{1}{100}$ part of the thickneſs of a hair of my Beard; but at other times, I have diſcerned them thicker, and according to all likelyhood, I here met with a place, where theſe tranſparent Veſſels were thinneſt. In all theſe my Obſervations, I paſs by many blood Veſſels, which are viſible to the naked Eye; for they are to appearance, like whole Rivers; whereas the other ſmaller Veſſels, of which I have before ſpoken, ſeem, but like ſmall Ditches or Channels.

I have alſo examined, the *Vitreus* or tranſparent parts of the brain of ſeveral Sparrows, immediately after their being killed; and have therein, not only cleerly diſcern'd, a great number of ſmall blood Veſſels, as in a Turkey; but as plainly, as in an Ox, or ſheep. Alſo the other parts, of the brains of a Sparrow, were very neer of the ſame bigneſs, with thoſe of an Ox: there being no other difference (the great blood Veſſels excepted,) but, that theſe conſiſted of a greater number of the ſame parts. There were alſo, in the *Cortical* parts, an incredible number of extream ſmall Veſſels, lying ſo cloſe to one another, that by reaſon of their tranſparency, they look't like Glaſs. The ſmallneſs of theſe Veſſels, I have ſo often meaſured, that I have no ſcruple remaining: nor will any one elſe doubt, who conſiders, what the Organs muſt be in Inſects, or what proofs thereof, we have within our ſelves. For, as I lately anotomized the Eye of a Man, I compared a ſtreak or Veſſel, I found in the *Choroides*, with the Axe of a courſe ſand, that was $\frac{1}{30}$th of an Inch, making upon my Scale 330 Microſcopical parts, now 8 of theſe ſtreaks, lying by the ſide of one another, made but $\frac{1}{330}$ of the Axe of the ſand, ſo that the foreſaid Axe, is 2640 times broader then the ſtreak. This number 2640, multiplyed Cubically, to finde out the ſolid content, it will make out, above 18 thouſand millions: ſo that a cours Sand, as before is ſaid, ought to be divided, into ſo many thouſand million parts, before it could paſs ſo thin a Veſſel.

The *Medullary* parts here, conſiſt chiefly of very ſmall ſtreakes or Veſſells, together with many ſmall blood Veſſells; as in the reſt of the brain: otherwiſe they differed little, from the ſame parts of an Ox, Sheep, or Turkey; as I have before deſcribed them, only, the tranſparent Oyl-like Globules, were not ſo large, but, when I obſerved the brain of a Sparrow, which had been 24 hours dead, I ſaw the tranſparent Oyl-like Globules, as great, as thoſe in the brain of an Ox, or other Animals. From this laſt, and other Obſervations, I have been conſidering, whether this great number of clear tranſparent Globules, might not, when the Animal was alive, have been deſigned to feed the *Medulla Spinalis* and Nerves: tho' now that Animal is dead, and the humours ceaſe to flow; the particles that toucht one another, congeal into figures of different ſizes: For the blood that is carryed by the Artery's, into the *Cortical* part of the brain, does not return thence, by the Veins, but is prepared in the *Capillary* Veſſels, till it be fit for the nouriſhment of the Medullary parts.

This may ſeem ſtrange to ſome, who might object that becauſe of the redneſs of the blood, the brain ought to be reddiſh of colour; but that followeth not; for the green Globules, of greeniſh flegm or ſnot, are truely blood Globules, which have changed their colour, being ſtill of the ſame ſize with them, and conſiſting each of 6 diſtinct Globules, as they doe: and I conclude that as theſe are changed, from red into green, that alſo, as likely the red may looſe their colour, and become white; eſpecially when they are divided into very ſmall parts as they muſt be, before they paſs into the *Capillary* Veſſels.

I have lately examined the Chryſtalline humour of the Eye of a Man, that I might know, whether the ſmall threds of the Scales, wind about in the ſame manner, as I have formerly deſcribed them, in the Eyes of beaſts: but I could not diſcern the true conſtitution thereof, notwithſtanding I have twice, and at two diſtinct times, endeavoured it. This I obſerve, that the Chryſtalline humor was not fine, and cleer, but yellowiſh, whereby it differed from the Eyes, which I had formerly ſeen of other Animals.

I have read the Book of Dr. Wm. *Ten Rhine*, out of which I cannot but note, that the ſaid Dr. agrees with my Obſervations concerning *Moxa*, written the 14th of May 1677. namely that *Moxa* is no artificial preparation of the Choiceſt Herbs, made by the Chineſes and Japoniers, as H. *Buſhof* affirms, in his Book of *Moxa*, pag ‘ 52. ‘ Saying, none of all the Druggiſts of Europe, have ‘any knowledg of the manner of preparing this *Moxa*; ‘ and by thoſe of *China*, this Art is of ſuch eſteem, that ‘ they will not for any money, diſcover it to a Stranger. But my opinion is, that *Moxa* is only a production of a fruit, like the downy ſubſtance about the Peach, the Quince, and ſuch like: and Dr. *Ten Rhine* holds, that it is a Wooll, of ſome leaf. I related alſo, in my forementiond letter, that I had made tryall of the burning of the *Moxa*, on my hand; what difference there was between that and Cotton, what may be the reaſons why the Chirurgeons eſteem Cotton fiery and churliſh, why it hurts a wound, when a band is made therewith, *viz*. becauſe the hairs are flat, and have ſharp edges or ſides.

I have tryed many other Woolly ſubſtances, which grow on ſome leaves and fruits, in what manner they burn, and chiefly the Woolly ſubſtance which the Poplar Tree ſheddeth; which Wooll, I had a conceit, when I had viewed it with my naked Eye, that it would burn quick: I had alſo the ſame Opinion, of the Woolly ſubſtance ſhed by the Willow Tree, in the beginning of June; which laſt, in the tryall excelled that of the Poplar Tree. But I have yet met with no Woolly ſubſtance, growing with us, which burneth ſo well as Cotton; and thoſe, who with

us,

us, undertake to cure the Gout, or any other diſeaſe, and have no *Moxa*, I would recommend to them Cotton.

I have alſo tryed the tinder of burnt linnen, but this burneth more fierce, and deep at once, then would be done at 10 times, with *Moxa* or Cotton.

A relation of mine, much troubled with the Gout, has his heel ſpoyl't with the great quantity of Chalk, that breaks out of it; this matter I examined in my Method, and ſeparated the ſame in 3 parts, the firſt was the dryeſt, and whiteſt, made of ſmall irregular parts, as if ſome ſmall ſands lay together; theſe thro' the Microſcope appeared very dark bodies, and each of them conſiſted of a great number of long tranſparent figures; which I can liken to nothing better, then to cut Horſe-hair, ſome thing ſharp at both ends. Theſe figures I judged ſo thin, that more then a 1000 of them lying, cloſe together, would not make out, the thickneſs of a hair of our head: I have repreſented ſome of them, that their proportion in thickneſs, to their length, might be comprehended, as Fig. 4. *A.* I have alſo found that theſe parts lay in very good order, one by the other, as in Fig. 5. *B.* and ſometimes 2, 3, or 4. and more in length. I have often ſeparated theſe ſmall ſand-like parts, one from the other, and again divided each of thoſe parts, and then, I have not only ſeen, the figures which conſtitute the white matter, as Fig. *B.* but for the moſt part, in a confuſed order, as Fig. 6. *C.* I have alſo ſeen ſome of theſe figures ſo ſhort, that ſome of them were in length but $\frac{1}{2}$ of Fig. *A.* and ſome but $\frac{1}{3}$, yea $\frac{1}{4}$ thereof, as here Fig. 7. *D.* but I conceived this was not their true length, but, that in the handling, they had broken. Among theſe figures, lay ſome irregular parts, which were again conſtituted of Particles, which I judged, had been Globules of blood, and had here in preſſing, bin broken or bruiſed; As alſo many roundiſh parts, which I judged, had been $\frac{1}{6}$

of a blood Globule: alſo ſome ſmall roundiſh particles, which I judged ſo ſmall, that 36 of them, would conſtitute but one Globule of blood.

The 2d ſort of this Chalky matter, not ſo white as the former; contained the forementioned irregular parts, of long figures, in a very tough cleer matter, mixed with blood Globules, and very many of the forenamed ſmall roundiſh parts.

The 3d ſort, was to the naked Eye, ſomewhat reddiſh; cauſed by the many blood Globules, mixed, throughout the ſlimy matter in the Chalk: It was alſo conſtituted of the beforementioned roundiſh parts.

Altho' with us the Hoſpitals (of the Lepers,) are in many places ruined, or converted to other uſes; and ſome learned Perſons, maintain, there is here no ſuch Incurable Leproſy; there are notwithſtanding, at Harlem, Searchers appointed, to viſit ſuch Perſons, as repair to them, pretending to that diſeaſe; who have power to grant men a ſeald Certificate, and a Clapper, whereby they are authorized, to beg their food, for 4 ſucceſſive years; afther which time, they muſt be again reviewed.

I inquired of one of theſe licenſed Men, wherein his diſeaſe conſiſted, and he ſhewed me his head, which was all covered with a skin, that ſcaled off, and red dry ſcabs: theſe ſcabs I gueſs to be cauſed by his ſcratching, or rubbing the part that itched, till the blood came, which blood afterward's dryed upon the place. This Perſon, as he ſaid, had his body whole and ſound.

Another of about 36 years of Age, had all his head and face ſound, and his head covered with black thick hair; but he ſaid, his whole body (part whereof I ſaw,) was beſet with great and ſmall, white and red ſplatches, and alſo red ſcabs: the white ſplatches, were places from whence the ſcabs, of their own accord ſcaled off; the red ſcabs, were cauſed as before, by the hard ſcratching

ing of the place, which cauſed the blood to iſſue out, and which dryed thereon; as the infected perſon alſo acknowledged. This perſon had been undertaken to be cured by 3, ſeverall men; the firſt, pretended to do it by Salves, but without effect: The ſecond, by blood letting; which he reiterated ſo often, that the Patient was much enfeebled thereby, but had no benefit; the third, who pretended great ſkill, purged him ſo often, that he became much weakned thereby; and was rather worſe: ſo that in the end, he was fain to repair to Harlem, for a Licence to beg. I cauſed this man to ſcratch gently ſome of the ſcales off from his leg, which I preſerved in a paper, and afterwards obſerving them, I found that in many places, they were beſet with ſmall parts of dryed blood and matter. A 3d perſon, whom I met, was a Youth about 12 years of Age, his head was covered with ſuch foul ſores, that I could not ſtay to view it, without loathing.

A 4th perſon I met, was a Woman, about 30 years of Age, who was likewiſe permitted to beg; ſhe ſaid, her diſeaſe conſiſted in the ſkins ſcaling fhom her head, which extreamly itched, and when ſcratched, did very much pain her, and alſo bled, and cauſed thoſe red ſcabs. She offer'd to uncover her head, but I was ſatisfied without it; the more for being from home, and lodging at a Friends houſe.

Of the Scales of Eels.

Among the Fiſhes, which are generated in our Rivers, and waters, I know but of two ſorts, that are ſaid to have no Scales; the one ſort is the Eele and *Paelink*, in ſome places not diſtinguiſhed, but with us they are diſtinguiſhed: the *Paling* being flatter and pleaſinger in taſt, and therefore ſold dearer: the 2d ſort, is the *Eelpout*, this laſt ſort are ſhort, and thick, and ſcarce to be met with;

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which two ſorts of Fiſh, the Jewes will not eat, as forbidden by the Law of Moſes Deutr. 10, 14, &c.

I examined the ſkins of theſe Fiſhes, after I had cleared them of their ſlime; and found them covered with Scales, as much as other River Fiſh: for the Scales, altho' very thin, and ſmall, lay orderly, and cloſe faſtned one over the other. Beſides theſe Fiſhes are alſo provided with Fins, like other Fiſh; for they have on each ſide of the head, a perfect Fin; the whole hinder part, or Taile, is as well above as under, furniſhed with a continued Fin. And for as much as this may ſeem ſtrange to ſome, and cheifly to the Jewes; who for want of a more neer ſearch, into the conſtitution of this Fiſh, have been diverted from ſo reliſhing a food: I cauſed one of thoſe Scales, which I had taken from under the Belly, where they are the leaſt, to be drawn out, as viewed by a Microſcope: but while the Artiſt was imployed in the doing thereof, he ſaid, he could as ſoon cut it in a Plate, as draw it, and I therefore cauſed him ſo to doe: of which you have here the Print Fig. 8. *ABCD.* is the Scale taken from the Belly of a great Eele, the Circumference of whoſe head, was neer 7 Inches; but the Scales on the back, and ſides are larger: the greateſt part of this Scale *ADC.* was covered by two other Scales: the part *B*, lay extended towards the Tail: the reſt lay after the ſame manner. Theſe Scales are for the moſt part, conſtituted of round Balls, and ſome oblong, in which Balls, in many places, appear figures, like a ſpiders webb; which for the extream fineſs and ſmallneſs, could not be imitated: the Globules conſtituting each Scale, are very tranſparent, but ſome more then others: and in each Globule, appeared a darkiſh ſpot; thoſe leſs tranſparent Globules, lay one by the other, and made different Circular lines in the Scales: altho' all the Scales, are not juſt of the ſame ſhape, I have yet obſerved, in many of them, as I judged, the ſame number of Circular lines. From

whence

whence I conclude, that every year, the Scale encreaſed one Circular line; and by conſequence, the number of theſe Circular lines, being ſeven; the Fiſh muſt have been ſeven years old. Theſe Circular lines are here denoted Fig. 8. by *EFGHIKL*. Fig. 9. is the ſame Scale in ſize, as it appears to our naked Eye.

I have alſo examined, the ſlime lodged on theſe Scales, but I can ſay little thereof, till I have made further Obſervations. &c.

Delft *July* 25*th*, 1684.

Philoſoph. Tranſact. Number, 168.

Fig. 1.

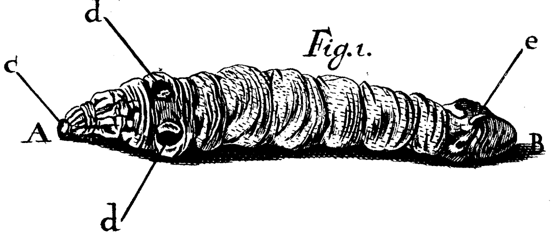

Fig. 3.

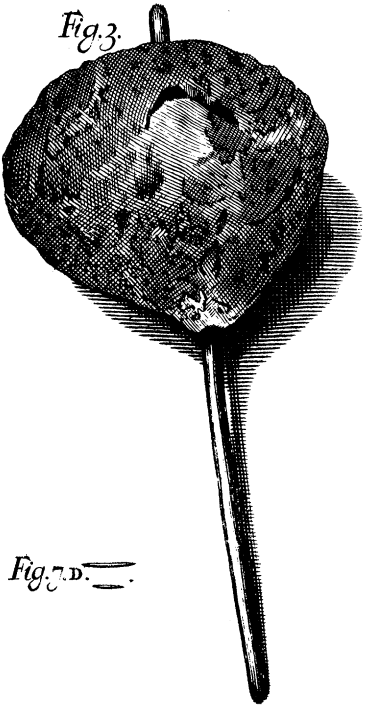

Fig. 2.

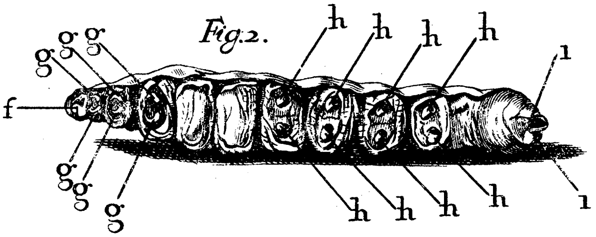

Fig. 4. A

Fig. 6. C

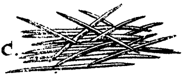

Fig. 7. D.

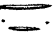

Fig. 5. B.

Fig. 8.

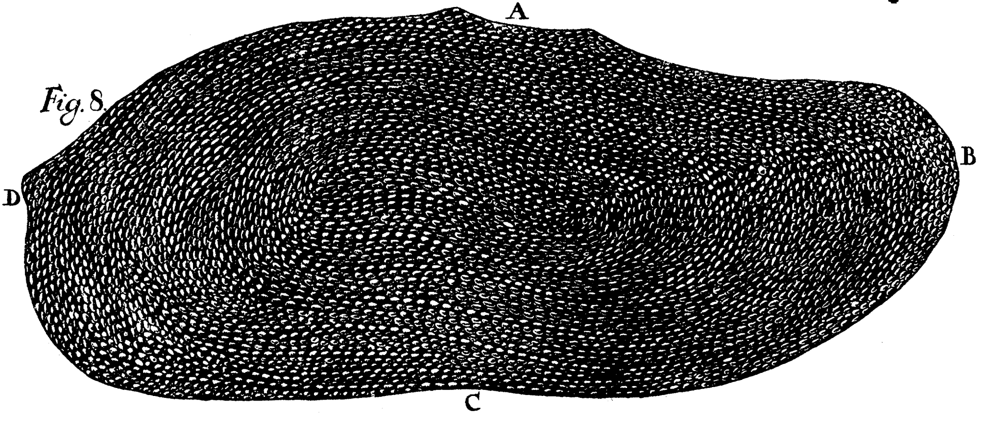

Fig. 9.

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